

Clim. Past Discuss., author comment AC2
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Reply on CC1

Chenyao Jiang et al.

Author comment on "Changes in paleo-underground water levels revealed by water wells and their relationship with climate variations in imperial China" by Chenyao Jiang et al., Clim. Past Discuss., <https://doi.org/10.5194/cp-2021-159-AC2>, 2022

The idea of this paper is quite novel and it is potentially suitable for CP, however the introduction of the data and the interpretation are not enough. My major concerns are as following,

Response: Thank you very much for providing the comments and suggestions to our manuscript. We have carefully revised our manuscript, and our point-by-point responses are listed below:

1. The introduction of the data sources is too brief, and should be strengthen. Maybe a few examples of the original data source would be helpful for readers to better understand them.

Response: Thank you very much for your suggestion. Our data were collected from 42 excavation reports, while 12 wells that residents in Nanjing are still using were measured by ourselves. As suggested, we have provided further details of our data sources and added the descriptions of some ancient wells in the revised manuscript (lines 77-80) such that readers could have a better idea about our data. Besides, we have also put down the details of every ancient well in the supplementary information.

2. The authors emphasised the 30N zone, but actually no evidence indicated the water levels changes of wells were related to the latitude 30N.

Response: Thank you for the comment. About the 30N zone, we only used it to delimit our study area. The vicinity of 30°N is known for the abundant records of ancient civilizations, where many people settled in this region in different dynasties. So, many ancient wells could be found in this region, which is very important for this research. Briefly, we investigated the 30N zone owing to the abundance of ancient wells records, and we did not seek to prove that the 30N is the explanatory factor of PUWL. To avoid confusion, we have also clarified this point in the revised manuscript (lines 44-50).

3. The direct cause of the variations of water levels of wells should be hydrology. Hydrology should be discussed on various scales, including channel change of rivers and desiccation/expansion of lakes.

Response: Thank you for the comment. We agree that the groundwater tables are directly influenced by hydrological factors, such as rivers and lakes. When the volume of rivers and lakes increases, it can also increase groundwater volume and hence, raise the underground water table levels, vice versa. But, it is worth mentioning that the volume of rivers and lakes is ultimately determined by climatic factors such as temperature and precipitation, which influence the total amount of evaporation and rainfall. Therefore, in this research, we seek to illustrate how and in what ways the variations of PUWL could be affected by climate changes.

4. Another major cause should be precipitation, and it should be helpful to compare the ancient wells in the lower reaches of Yangtze River with local and regional precipitation chronologies, instead of the temperature chronologies.

Response: Thank you very much for the comment. Previous studies indicated a significant correlation between the PUWL variations and the sea-level fluctuations in the coastal regions (Shen and Zhu, 2004; Sivan et al., 2004). In addition, the fluctuations of sea levels were driven by the temperature changes (Rohling et al., 2009; Siddall et al., 2010; Kopp et al., 2016), as the rising and falling temperatures would lead to the melting and the growth of glaciers and subsequently result in the rise and the fall of sea levels (Clark et al., 2001). The above studies reveal that PUWL in coastal areas is significantly affected by sea-level changes, while temperature changes drive sea-level changes. As the lower reaches of the Yangtze River are located in the coastal areas, we compare the PUWL variations with the temperature changes (instead of precipitation changes). The above point has been further elaborated in the revised manuscript (lines 149-169).

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